Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Issued October 2, 1911.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE—BULLETIN 97.
HENRY S. GRAVES, Forester.

OCT 3 1911
Department

COYOTE-PROOF INCLOSURES IN CONNECTION WITH RANGE LAMBING GROUNDS.

BY

JAMES T. JARDINE,
INSPECTOR OF GRAZING.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1911.

Issued October 2, 1911.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE—BULLETIN 97.
HENRY S. GRAVES, Forester.

COYOTE-PROOF INCLOSURES IN CONNECTION WITH RANGE LAMBING GROUNDS.

BY

JAMES T. JARDINE,
INSPECTOR OF GRAZING.

1862 1889

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1911.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Forest Service,
Washington, D. C., May 12, 1911.

Sir: I have the honor to transmit herewith a manuscript entitled "Coyote-Proof Inclosures in Connection with Range Lambing Grounds," by James T. Jardine, Inspector of Grazing, and to recommend its publication as Bulletin 97 of the Forest Service.

Respectfully,

Henry S. Graves,
Forester.

Hon. James Wilson,
Secretary of Agriculture.

CONTENTS.

Page.
Need of improved range lambing methods 7
Investigations prior to 1910 8
Results secured by a sheep owner 9
Experiments in 1910 with small inclosures 10
  Object of the inclosures 10
  Location 10
  Plan 11
  The fence 11
    Specifications 11
    Cost 12
  Discussion of Tables 1 and 2 13
    Materials 13
    Transportation of material 14
    Travel and team hire 14
    Making and setting posts 14
    Bracing 14
    Stretching wire 15
    Gates 16
The range and sheep 17
  The range 17
  The sheep 17
Management of ewes during lambing—experimental band 17
  Night drop 17
  Day drop 19
  In the pastures 19
  Doubtfuls 20
    Lambs not owned by mother ewes 20
    Substitute lambs 22
    Twin lambs 22
Management of ewes during lambing—outside bands 23
Results 23
Discussion of results 24
  Increase in lambs saved due to pastures 25
Causes of loss from experimental band 25
  Lambs yeaned dead or premature 26
  Single lambs lost in pastures 26
  Single lambs over five days old lost on range prior to marking, July 3 27
Advantages of such a system of pastures 28
  Increase in the percentage of lambs saved 29
  Decrease in amount of labor necessary 29
  Ewes and lambs in better condition at the end of the lambing period 30
  Greater degree of certainty in the lamb crop 30
  Difficulty and worry of securing labor partly eliminated 31
  Decrease in the acreage of range used 31
Money returns from inclosures 31

ILLUSTRATIONS.

PLATES.

Page.

Plate I. Fig. 1.—Unlambed ewe band under herding on open range, northeastern Oregon, 1909. Fig. 2.—Unlambed ewes as they divide into small bunches in pasture, northeastern Oregon, 1909 8

II.—View showing the general character of the lambing range and pastures, Cochetopa National Forest, Colorado 16

TEXT FIGURES.

Fig. 1. Plan of lambing inclosures 11

2. System of fence bracing 15

3. Carnero lambing allotment and experimental lambing pastures 18

COYOTE-PROOF INCLOSURES IN CONNECTION WITH RANGE LAMBING GROUNDS.

NEED OF IMPROVED RANGE LAMBING METHODS.

In the year 1910 there were, according to the Yearbook of the Department of Agriculture, over 35,000,000 sheep in the Rocky Mountain and Pacific coast States. Of these something over 7,500,000 were grazed on National Forest range. About 75 per cent of the sheep grazed on National Forests, or over 5,600,000 head, were ewes with lambs. Of the 27,500,000 grazed off the Forests, perhaps one-half were breeding ewes. In other words, there are in the far Western States about 20,000,000 head of breeding ewes.

While a small percentage of these sheep were lambed on private fields or in feed yards or sheds, most of them were lambed on open range, either public domain or private holdings in the neighborhood of the National Forests. The number lambed under permit on the Forests was about 1,100,000.

When it is considered that the lambs must be yeaned in early spring, while range feed is short and cold storms are frequent; that extra, expert care is necessary during the yeaning period; that the difficulty of securing this necessary expert labor is a discouraging feature of the sheep industry in the West; and that unless carefully managed during the lambing season sheep are very injurious to the ranges—when all these matters are considered the problem of lambing the 20,000,000 ewes is seen to be of large importance. One careless attendant in each camp may easily cause the loss of one lamb out of every 100. Yet this is only one of the many sources of loss. Approximately 10 per cent of all lambs dropped on the range are dead when yeaned or die before they are 3 weeks old. This is an annual loss of 2,000,000 lambs. At best there will be some loss as long as the ewes are handled in large bands and lambed on the range, but it does not seem that this loss should reach 10 per cent.

Besides the actual loss by death, there may be an indirect loss from other sources if the ewes and lambs do not receive very careful management during the lambing period. Lambs make the most rapid and cheapest growth early, and a difference in the treatment they receive during the first month will certainly be in evidence at the fall weighing. A difference of 1 pound each in the weight of the lambs in the far Western States would amount to approximately 15,000,000 pounds, worth in an average year not less than $500,000. The difference traceable to the method of handling during this first month is not always limited to 1 pound.

The welfare of the ewes, the welfare of the range, the cost of handling, and the difficulty and worry of securing the necessary labor at a cost not prohibitive are additional items of importance. The profit resulting from the handling of 20,000,000 range-breeding ewes is in question, and sheepmen, as well as men engaged in investigations, should work for the devising and adoption of improved methods. Two main objects are to be sought. The first is to make results more uniform and more certain by guarding against possible heavy loss due to severe storms or to shortage of feed. The second is to get rid, so far as practicable, of the small but constant losses due to insufficient or inefficient help, rough handling, diseases peculiar to the young lamb, lack of attention to "outlaw" ewes, weak ewes, weak lambs, and twin lambs, and losses due to predatory animals. An extra 5 per cent of lambs saved would in many cases mean an increase of 25 per cent in the net profit from the lamb crop.

INVESTIGATIONS PRIOR TO 1910.

In 1907 the Forest Service and the Bureau of Plant Industry began a cooperative study to learn what might be accomplished through the use of coyote-proof pastures in handling sheep. The results of the earlier experiments have been presented in Forest Service Circulars 156, 160, and 178. In the first experiment a band of ewes and lambs was handled in a coyote-proof pasture during the summer season, with results highly favorable both to the sheep and the range. It was then decided to extend the experiment to cover the lambing of a band of ewes in a coyote-proof pasture.

The first step taken was to make a comparative study of lambing under the methods prevalent on open range and lambing in pastures. These observations were made during March, April, and May of 1909, and the results were published as a part of Forest Service Circular 178, pages 32 to 40.

In pastures, 610 ewes were lambed on 320 acres of open, yellow-pine range. They were given no attention other than the care of one shepherd during the forenoon of each day for one month. From the 610 ewes, 570 good strong lambs—93.5 per cent of the total ewes—were marked at the end of the month. In the same locality 8 men were employed for each band of 1,000 ewes lambed on the open range, and the number of lambs marked varied from 85 per cent to 102 per cent of the total ewes. Much more ground was required under the open-range system, and the cost for labor alone was $250 for each 1,000 ewes. For the same number in pastures the labor would have amounted to $41.

The results brought out by these investigations and other general observations led the writer to state that "where an individual has title to lambing range of moderate or high-carrying capacity, readily accessible from a shipping point, the increase in carrying capacity and

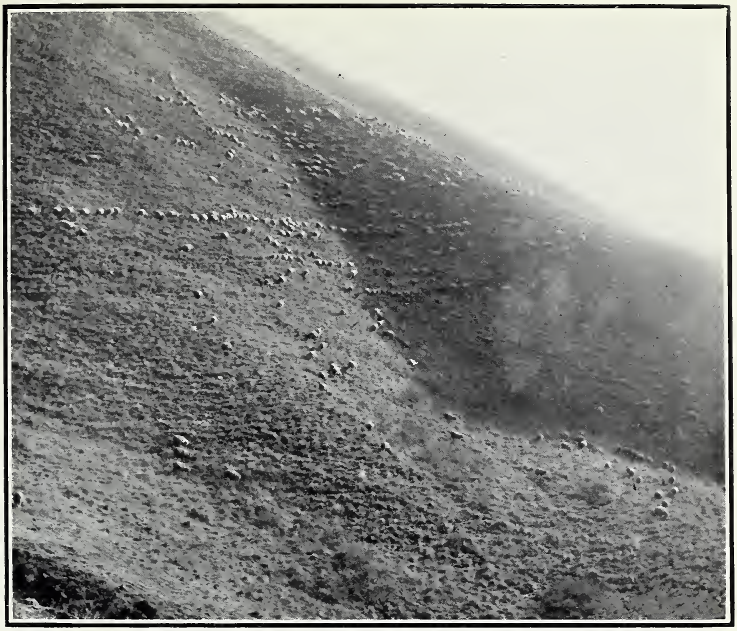


FIG. 1.—UNLAMBED EWE BAND UNDER HERDING ON OPEN RANGE. NORTHEASTERN OREGON, 1909.

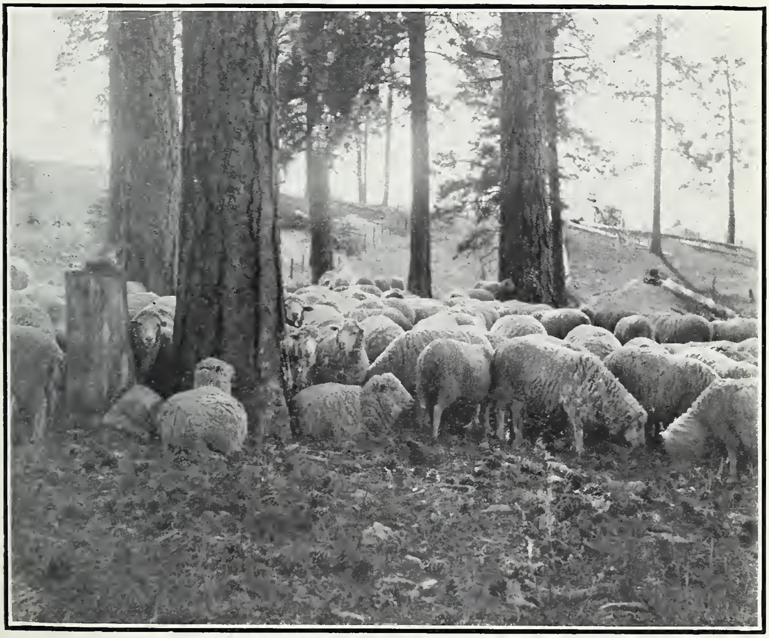


FIG. 2.—UNLAMBED EWES AS THEY DIVIDE INTO SMALL BUNCHES IN PASTURE. NORTHEASTERN OREGON, 1909.

decrease in expense of handling in pasture during the lambing season will justify the cost of construction necessary to inclose the entire allotment.[1]

RESULTS SECURED BY A SHEEP OWNER.

As further justification of this statement, the results secured by a private individual are presented in the following extracts from a letter received from Mr. F. H. Taylor, of Mancos, Colo.:

> After reading the description of your coyote-proof fence in Oregon, I constructed a fence to inclose about 500 acres in the same manner. The fence was constructed during the fall of 1908, and in the springs of 1909 and 1910 1,000 head of ewes were lambed in this inclosure. One hundred per cent [2] of lambs were saved, and one man did all the work. I think the per cent of the lambs would have been higher, but one animal, presumably a coyote, was inside when the fence was constructed. It was impossible to capture this animal even with the hounds. Some of the herders thought the animal was not a coyote, but since coyote tracks were found in several places, I am of the opinion that it was. Whatever animal it was, it raised its young inside the inclosure.
>
> A great many of the lambs were killed and a small hole eaten behind the foreleg and the remainder of the carcass was untouched. On the land outside of the inclosure it required the services of 3 men and a pack of hounds to care for 1,000 ewes, and only 95 per cent of the lambs were saved. This per cent could not have been saved without the assistance of the hounds.
>
> I consider this fence a splendid investment, since it easily pays for itself in three years. On the other hand, it is often difficult and sometimes impossible to get men during the lambing season. For this reason the money value of the fence can hardly be estimated.
>
> There is one suggestion I have to offer in the method of construction; that is, that a barbed wire be placed on the ground before the woven wire is unrolled. I expect to build another inclosure soon, and will have a barbed wire stretched around the inclosure and have the men place their feet on the wire and press it close to the ground and staple it. With the fence already constructed it seemed almost impossible to get the wire as close to the ground as necessary on account of the uneven surface.

The area fenced by Mr. Taylor is slightly rolling, foothill country, at an elevation of approximately 7,500 feet, situated 8 miles from the railroad station at Mancos, Colo. The fence is approximately 4 miles in length, and cost $1,651.46 exclusive of transporting the wire from the railroad station to the pasture site, which was done by Mr. Taylor himself. The following data on cost will give an idea of the expense incurred for various items:

Cutting, hauling, and setting 1,280 posts, at 20 cents each	$256.00
1,280 rods of woven wire, at 46 cents per rod	588.80
1,280 rods of barbed wire, at $0.2659 per rod	340.33
1,280 rods of twisted smooth wire, at $0.2659 per rod	340.33
Stretching 4 miles of fence, at $30 per mile	120.00
150 pounds staples, at 4 cents per pound	6.00
Total	1,651.46
Cost per mile	412.865

---

[1] Forest Service Circular 178, p. 40.

[2] One hundred per cent here means that the number of lambs saved was equal to the number of ewes.

EXPERIMENTS IN 1910 WITH SMALL INCLOSURES.

OBJECT OF THE INCLOSURES.

The results given above were secured in pastures large enough to accommodate all the ewes throughout the lambing period. There are, however, many lambing grounds both on National Forests and in the vicinity of National Forests which are low in carrying capacity, remote from railroad points, and either almost or entirely inaccessible by wagon. In such cases the cost of placing wire on the ground and constructing a satisfactory fence is too great to justify the inclosing of an entire lambing ground. With the hope of meeting the more urgent needs of localities so situated, a special system of pastures on a smaller scale was devised and an experiment initiated during the lambing season of 1910.

In a band of range ewes there are always a few weak lambs requiring special care; a few poor ewes which should have quiet and good feed in order to produce milk enough for the lamb; a few ewes which naturally, or as the result of fright, will not own and mother their lambs as they should; a few ewes which should adopt substitute lambs; and ewes with twin lambs which always need special attention and care if the twin lambs are to make a profitable growth. By the shepherd these are recognized as "doubtfuls," requiring individual attention and quiet, patient care, which not infrequently exhausts the cheerfulness of the most painstaking attendant. If the ewes have been half starved during the winter and are lambing on scant forage, the "doubtfuls" may increase to a horde. Without some provision for administering special care, the loss in such cases will be large, and in the best of seasons it will amount to 2 or 3 per cent of the total number of lambs yeaned.

The prime object of the system of pastures planned and initiated in 1910 was to meet the needs of the shepherd in handling these doubtful cases, and also to provide quiet and protection in small bunches for all the ewes with lambs until the lambs were 5 days old. At this age single lambs in good condition and properly mothered can usually be collected to make up the lamb band.

LOCATION.

The experiment was initiated on the Cochetopa National Forest, in southern Colorado, because of the special opportunity for studying the problem afforded by the character of its lambing ranges and the difficulties which the sheepmen have to contend against during the lambing season.

Two sets of pastures were constructed, one set in connection with a lambing allotment on the South Fork of Carnero Creek, the other in connection with an allotment on the West Fork of Cochetopa Creek.

Both were at an elevation of about 9,000 feet. On Carnero Creek the inclosures were completed in time for use during the lambing season of 1910. The Cochetopa project was not completed until July 1, and will be ready for use in 1911.

PLAN.

On each project approximately 50 acres of untimbered meadow and bunchgrass range were inclosed. The inclosure was divided into six compartments, four of 10 acres each and two of 5 acres each. The division fences were so arranged as to secure water in each compartment. The two small compartments were for ewes with twin lambs and all doubtful cases of ewes with single lambs. The four larger compartments were used for handling the ewes with single lambs until the lambs were 4 or 5 days old. Figure 1 shows the arrangement of the inclosures on the Carnero project.

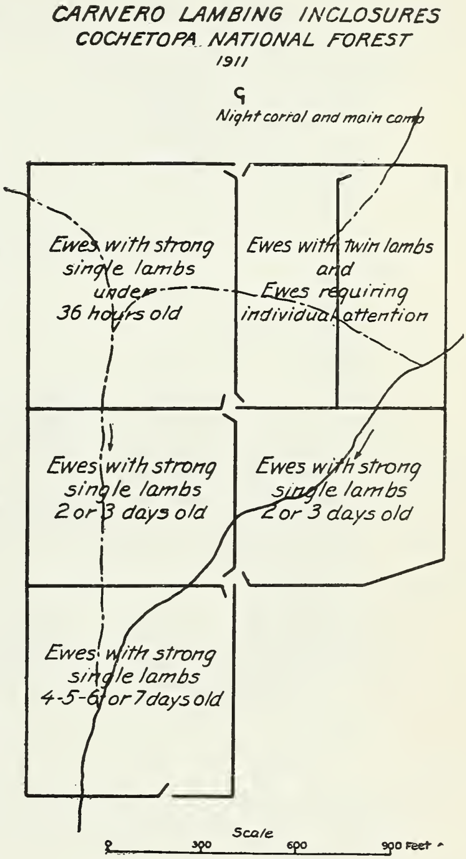

CARNERO LAMBING INCLOSURES
COCHETOPA NATIONAL FOREST
1911
Night corral and main camp
Ewes with strong single lambs under 36 hours old
Ewes with twin lambs and Ewes requiring individual attention
Ewes with strong single lambs 2 or 3 days old
Ewes with strong single lambs 2 or 3 days old
Ewes with strong single lambs 4-5-6 or 7 days old
Scale
0
300
600
900 Feet

FIG. 1.—Plan of lambing inclosures.

THE FENCE.

SPECIFICATIONS.

The fence was constructed in accordance with the following specifications, slight changes being made as necessary to meet the unevenness of the ground:

Posts set not less than 2 feet into the ground, from 10 to 30 feet apart; stays made from small poles or edgings placed every 8 feet between posts; on the surface of the ground a barbed wire; 3 inches above this a 34-inch lawn fence with 4-inch triangular mesh; 5 inches above the woven wire a barbed wire; 6 inches higher a second barbed wire; 7 inches above this a third barbed wire.

As a matter of fact, the posts were put 2½ feet into the ground and, with slight variation, 1 rod apart. Stays were used only where necessary on account of unevenness of the ground.

COST.

Many inquiries have been made regarding the cost of such a fence. Tables 1 and 2 give the itemized cost per rod and per mile incurred in constructing the Carnero project and the Cochetopa project, respectively. The data were segregated under the headings given, with a view to rendering the tables most useful as a basis for estimating the cost of such a fence under special local conditions.

TABLE 1.—*Cost of coyote-proof fence—Carnero project.*

	Per rod.		Per mile.	
A. Cost of fence per rod and per mile:				
Cost of material at railroad station—				
Woven-wire fence, 34-inch, with 4-inch triangular mesh	$0.49		$156.80	
Four barbed wires, at $0.0345 per rod	.138		44.16	
Staples	.005		1.60	
Spikes and nails	.005		1.60	
		$0.638		$204.16
Cost of transporting wire from railroad station to site—				
Woven-wire fence	.1121		35.872	
Barbed wires (4)	.0355		11.36	
Staples	.00135		.432	
Spikes and nails	.00135		.432	
		.1503		48.096
Cost of construction, exclusive of gates—				
Wages and board of 4 men 4 days en route to and from site	.0788		25.216	
Team expense—hire and subsistence	.1782		57.024	
Cutting posts	.0800		25.60	
Digging postholes, exclusive of 4-foot gate holes	.1300		41.60	
Setting posts	.085		27.60	
Distributing materials, bracing, stretching wire, and patching holes at bottom of fence	.2822		90.304	
		.8342		266.944
Total cost of fence per rod and per mile		1.6225		519.20
B. Cost of entire project:				
Cost of 660 rods of fence, at $1.6225 per rod				1,070.85
Cost of 10 gates—				
Rough lumber			$10.00	
Ten sets of gate hangers complete			30.00	
Getting out timbers, digging 4-foot holes, and putting up gate frames			30.00	
Making and hanging 10 gates			16.00	
				86.00
Miscellaneous—				
Tools (axes, wire stretchers, grindstone, etc.)			15.48	
Lumber for construction camp			9.78	
Blacksmithing			10.05	
				35.31
Total cost of project				1,192.16

TABLE 2.—*Cost of coyote-proof fence—Cochetopa project.*

	Per rod.		Per mile.	
A. Cost of fence per rod and per mile:				
Cost of material at railroad station—				
Woven wire fence, 34-inch, with 4-inch triangular mesh	$0.49		$156.80	
Four barbed wires, at $0.0345 per rod	.138		44.16	
Staples	.005		1.60	
Spikes and nails	.005		1.60	
		$0.638		$204.16
Cost of transporting materials from railroad station to site—				
Woven wire fence	.1535		49.12	
Barbed wires (4)	.0349		11.168	
Staples	.00125		.40	
Spikes and nails	.00125		.40	
		.1909		61.088
Cost of construction exclusive of gates—				
Wages and board of 5 men for 3 days en route to and from the site—50 miles from town	.0685		21.92	
Cutting posts	.07		22.40	
Digging post holes	.12		38.40	
Setting posts	.06		19.20	
Team hire distributing all materials.	.10		32.00	
Bracing, stretching wire, and patching holes	.256		81.92	
		.6745		215.84
Total cost of fence per rod and per mile		1.5034		481.088
B. Cost of entire project:				
Cost of 700 rods of fence[1]				1,131.00
Cost of 12 gates—				
Rough lumber—100 pieces 1 by 6 by 12, at $17 per M			$10.20	
Twelve sets of gate hangers			33.95	
Getting out timbers, digging 4-foot holes, and putting up gate frames			35.85	
Making and hanging gates			20.00	
				100.00
Miscellaneous—				
Wire stretchers, one-half charged to Carnero project			3.47	
Wire splicers			.40	
				3.87
Total cost of project				1,134.87

DISCUSSION OF TABLES 1 AND 2.

MATERIALS.

It may be noted that the total cost for woven wire, barbed wire, staples, and nails was $0.638 per rod at the nearest railroad station. This item of cost should apply very closely to conditions in any locality of the West.

---

[1] The total cost is less than the product of cost per rod times 700 rods, due to the fact that on part of the cross fences only three barbed wires were used. The above cost per rod and mile is for the fence built in accordance with the specifications preceding.

TRANSPORTATION OF MATERIAL.

The cost of transportation will hardly be the same for any two localities or any two projects. Where horses and wagons are owned by the builder of the fence the wire may be hauled at times when other work is not urgent, in which case the actual cash outlay for transportation may be very small. For the Carnero project the wire was hauled by wagon approximately 80 miles. The hauling was done in May, when the roads were soft and in many places almost impassable. Under such conditions the contract rate of $0.90 per 100 pounds was reasonable. Yet it amounted to a cash outlay of $0.1503 per rod, or $48.09 per mile. For the Cochetopa project the transportation by wagon was approximately 70 miles, and it cost at the rate of $0.1909 per rod of fence, or $61.09 per mile. These figures indicate how the first cost of the fence would be cut down under more favorable conditions, or where the individual is prepared to do his own hauling.

TRAVEL AND TEAM HIRE.

Special attention is called to two items. To get the men to and from the Carnero project cost the equivalent of $0.0788 per rod of fence constructed, or $25.27 per mile, while team hire and subsistence amounted to $32 per mile of fence on one project and $57.02 per mile on the other. The actual work for a team in distributing materials amounted to perhaps four or five days, yet it was essential to have them on or near the project all the time. The rental was $2 and feed—hay and grain—for every day the team was away from town. This last item, at least, would amount to much less for a private individual, who, if he did not own a team, would rather buy one and chance selling it when the work was completed than pay out so much for rental.

MAKING AND SETTING POSTS.

The posts were all large, averaging not less than 5 inches at the small end. They were set in holes 2½ feet deep, and the work was well done in every respect. The men worked eight hours a day, and the wage paid was $2 and board, except for the foreman, who received $3 and board.

BRACING.

Unless the woven wire as well as the barbed wire remain taut, there will be a weakness in the fence. If the woven wire is loose, it can be pushed in or out away from the barbed wire above or below it. If the barbed wires are loose, they are readily pushed up or down and a 5-inch space becomes one of 8 or 10 inches. On even ground the fence should be well braced at least every one-eighth mile. On uneven ground the distance between stretching stations is necessarily short and the bracing required for the purpose of stretching the woven wire is sufficient to hold the fence rigid. There are several effective methods of bracing. The system of bracing shown in figure 2 can be recommended for its simplicity, efficiency, and adaptability to the materials usually at hand.

For braces *a* and *a′* poles from 4 to 6 inches in diameter may be used. For the tension members *b* and *b′* barbed wire may be used, although smooth wire is easier to handle. Except when the distance between stations is only a few rods, posts A and B should be set from 3 to 4 feet in the ground, depending upon the solidity of the soil. The usual depth of 2½ feet is sufficient for post C. Care should be exercised to see that the bracing poles fit snugly and to place them at the proper height from the ground. Not infrequently the brace is placed too high or too low; the result is that the post, even though set firmly, may rise in the ground and allow the wires to slacken. For a fence built according to the specifications already given the braces should be placed as shown in figure 2. Where a horizontal brace is used instead of brace *a*, it should be placed approximately 34 inches from the ground surface. If so placed the braces will be effective in resisting the pull of the wire, and they will not be above the woven wire to tempt coyotes or cats to reach for them and force through between the wires.

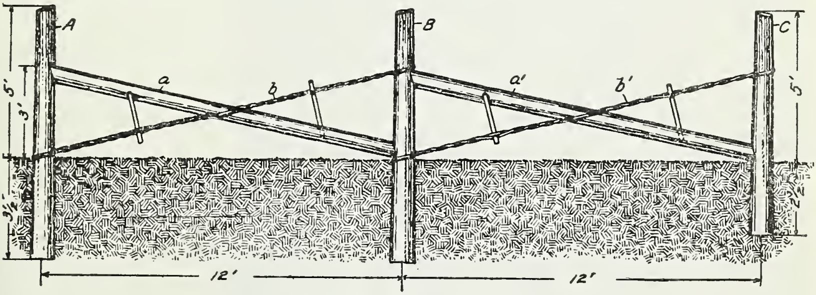


FIG. 2.—System of fence bracing.

STRETCHING WIRE.

It was found most convenient to stretch the ground barbed wire first, as in many places it was necessary to trench through small hummocks in order to get the wire to the ground in slight depressions. The efficiency of the fence as a protection against coyotes depends to a great extent upon the closing of all holes at the bottom. For this reason a barbed wire was stretched on the ground in all places; in soft ground, where coyotes might readily scratch under, a barbed wire was stretched below the ground surface; and where necessary to prevent leaving a space of more than 3 inches between the ground wire and the bottom of the woven wire, extra barbed wires were used.

The rapidity with which the woven wire can be stretched depends very largely upon the regularity of the ground surface and the experience of the men doing the work. On the Carnero project a crew of three men stretched from 40 rods to 150 rods a day. A few suggestions will be helpful to those proceeding without experience:

Be provided with splicers, a heavy wrench, one stretcher suitable for straight pulls, and one for use at corners and in V-shaped draws, heavy cutting pincers, hammers, ax, pick, and shovel. Where the slope changes decidedly the woven wire should be stretched up to the new slope, cut in two, and stapled around the post so as to bring the top and bottom of the wire parallel to the new slope. Where the ground is somewhat irregular but there is no change in the general angle of the slope, make a pull of 20 rods or more; apply a force sufficient to take up all the loose wire; then on the hummocks raise the wire to the desired position and staple the top, and in depressions push it down and staple the bottom, placing the staples so that they will allow a movement of the strands horizontally, but not up or down; the final pull may then be applied and the wire will adjust itself to slight irregularities of surface without "buckling."

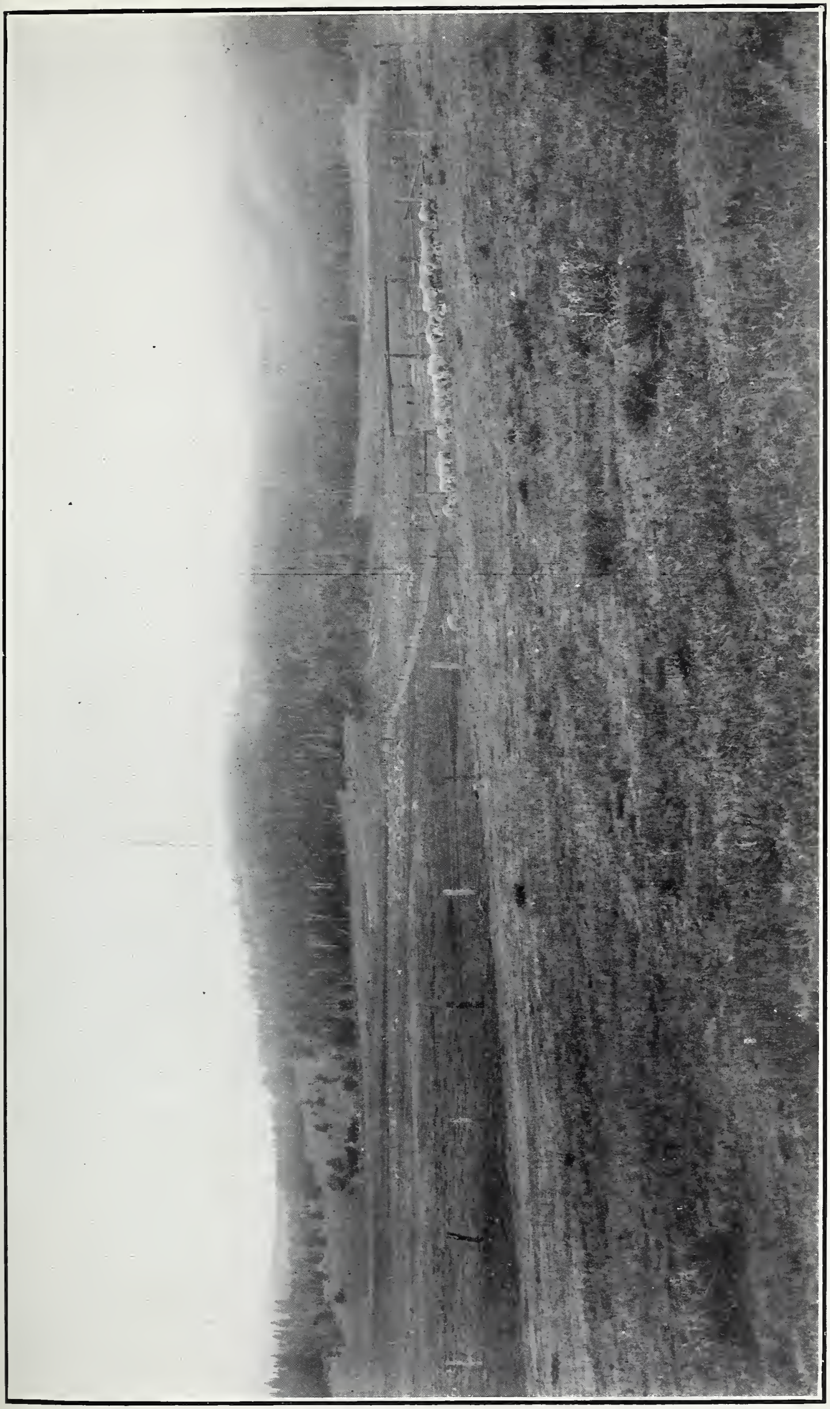
To make a splice in a 34-inch woven wire of 4-inch mesh requires considerable time and should be avoided, as far as possible, by securing rolls as large as can be conveniently transported. At least 20-rod or 30-rod rolls should be used.

GATES.

In each of the projects the gates were substantial and convenient. While a convenient swinging gate facilitates handling, it is not essential to the success of the system of pastures. A sliding-panel gate made of any boards at hand would serve if it were desired to make the cost as small as possible at the expense of convenience. The gates, however, must be tight enough to prevent lambs from creeping through and high enough so that ewes can not jump over them; otherwise the shepherd will have no end of annoyance, and there will be an occasional loss due to the starvation of a strayed lamb.

The general appearance of the gates and the arrangement of three which open to the outside range and to any one of three pasture compartments are shown in Plate II.

It is believed that a private individual could duplicate either of these projects for approximately $1,000. In most localities his men would work 10 hours a day; the expense listed under team hire and travel could be cut down, and it would be possible to take advantage of good roads for wire transportation. In many localities the cost would be less and in some few perhaps higher, depending largely upon difficulty of transportation, availability of timber, ruggedness of the area, and the difficulty of digging holes.



VIEW SHOWING THE GENERAL CHARACTER OF THE LAMBING RANGE AND PASTURES. COCHETOPA NATIONAL FOREST, COLORADO.

THE RANGE AND SHEEP.

THE RANGE.

A proper judgment of the method of management and the results secured calls for some knowledge concerning the lambing allotment and the ewes at the beginning of the lambing season.

The location of the inclosures with respect to the main camp and to the complete allotment is shown on the accompanying map, figure 3. This figure shows also the character of the range, the portion used by the unlambed ewes, and the portion used by the ewes with lambs, after they were removed from the pastures.

THE SHEEP.

The band was made up of 1,006 ewes, varying in age from 2 years to 10 years, and 325 yearlings, nearly all ewes. The year-old ewes had been kept with the breeding ewes during the breeding period the previous December, and a few of them dropped lambs. The 325 yearlings were run with the drop band during the lambing—this by no means at the writer's suggestion, as yearlings are a pernicious factor, exciting the pregnant ewes, interfering with ewes and newly-dropped lambs, and causing general confusion. For the best results all dry sheep of whatever age should be separated from the pregnant ewes, if possible, before lambing. At least, no large number of yearlings should be tolerated.

The band was entirely of grade ewes. The largest part was Merino, but there were many Lincoln and Shropshire ewes. They were in fair condition and were strong, but the wool on many of them gave evidence of hardship during the previous winter. As a whole, they fairly represented the ewe bands in that neighborhood.

The herders were all Mexicans, the foreman alone speaking English.

MANAGEMENT OF EWES DURING LAMBING—EXPERIMENTAL BAND

NIGHT DROP.

Each night the unlambed ewes were corralled at the main camp, shown on figure 3. There was no shed protection at the corral, but the surrounding aspens served to keep out cold winds. Once in the corral, no attention was given them until daybreak the next morning. The band was then allowed to move from the corral at will, leaving behind the ewes which had yeaned lambs during the night. One man accompanied the drop band on the range. The foreman and another man gave their attention to the ewes with lambs left behind.

Usually when a thousand or more lambing ewes are left unattended in one corral during the night there is more or less confusion among the mothers and newly dropped lambs when the shepherd appears in the morning. This case was no exception. Out of 25 or 30 lambs dropped during the night, not infrequently there were 4 or 5

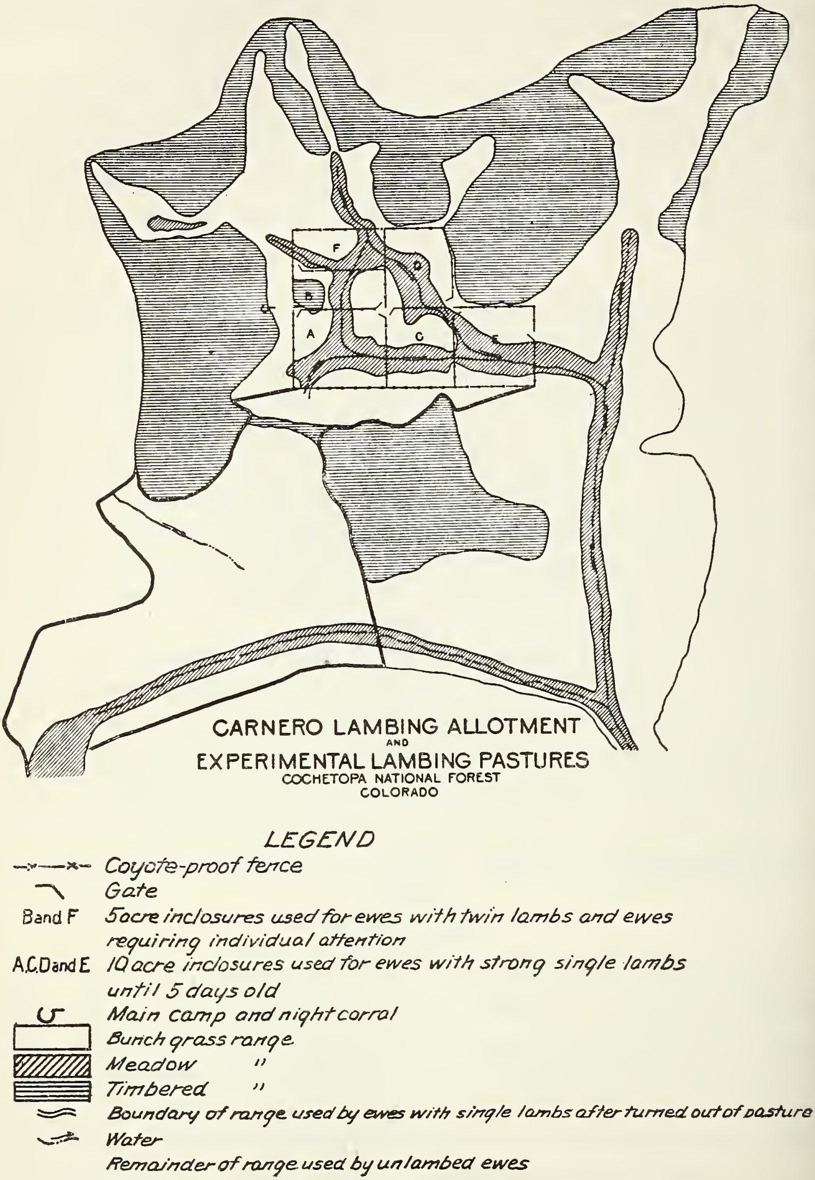

F
D
B
A
C
E
CARNERO LAMBING ALLOTMENT
AND
EXPERIMENTAL LAMBING PASTURES
COCHETOPA NATIONAL FOREST
COLORADO
LEGEND
Coyote-proof fence
Gate
B and F 5 acre inclosures used for ewes with twin lambs and ewes requiring individual attention
A,C,D and E 10 acre inclosures used for ewes with strong single lambs until 5 days old
Main camp and night corral
Bunch grass range
Meadow "
Timbered "
Boundary of range used by ewes with single lambs after turned out of pasture
Water
Remainder of range used by unlambed ewes

FIG. 3.—Carnero lambing allotment and experimental lambing pastures.

without mothers, wandering aimlessly about the corral or tottering drowsily, half-starved, in the protection of the fence or a tree. The first task of the foreman and his assistant was to bring order out of this chaos by finding mothers for all the lambs. Occasionally there were more lambs than ewes, which indicated either that one or more mothers had deserted and gone out with the drop band or that the extra lambs had been deserted by ewes which had yeaned twins. If the attendants succeeded in finding each lamb owned by its mother, it was considered a stroke of good luck. More often there were 1 or 2, or as many as 5, whose mothers had to be hobbled or close penned until they developed an affection for the lamb. This confusion is familiar to all who are accustomed to such a method of handling. It will be the subject of comment and suggestion later in this bulletin.

After a mother was found for each of the lambs they were left quietly in the corral or allowed to drift on to the grass near by for a few hours until the sun was warm and the lambs strong enough to move about with the ewes. Each ewe with one strong lamb, properly mothered, was then put with her lamb into pasture "A," figure 3. The ewes with twin lambs, ewes with weak or sick lambs, ewes with large teats, ewes not properly owning their lambs, and any others which needed individual attention were put into pasture "B," figure 3.

DAY DROP.

The work at the corral was usually completed before 11 o'clock and one of the men at the corral joined the shepherd in the field to care for the day drop. When the drop band were near the pastures the day drop was at first put into pasture "A" at night, but it was found more satisfactory to put them in a small corral, moving them no farther than was absolutely necessary for protection until they were nearly a day old. Then they were treated as the night drop were; the ewes with single lambs in good condition were put into pasture "A" and the ewes with twins and all "doubtfuls" into pasture "B."

IN THE PASTURES.

After the first day it was necessary each morning to remove the ewes and lambs from pasture "A" in order to make room as near to camp as possible for the drop of the previous 24 hours. From pasture "A" they were placed either in pasture "C" or pasture "D," where they would remain for two days. They were then all moved to pasture "E," except during a short period when the drop of 24 hours amounted to from 50 to 70 lambs. In this way most of the lambs were 5 days old, and many of them 7 days old, before they were turned out on the range. Any lamb which appeared to need special care was kept in the pastures still longer. Those turned out remained in small bunches near camp for a few days, and were then collected into larger bunches and finally made up the lamb band.

Each morning and evening the foreman went through the pastures containing the ewes with single lambs, counted the ewes and the lambs, and where necessary and possible cared for the needy ones. Although lambs a few days old are usually hardy, their ailments appear to be many and not infrequently prove fatal within a few hours. The main object at the pastures was to keep them out of prairie-dog holes, of which there were a multitude; to remove the hardened obstructions from the tail; to administer to other small wants; and to see that each mother was bestowing the proper affection on her lamb, and that the flow of milk was sufficient to rear it. If a lamb was found neglected it was put, along with the mother, into pasture ''B'' with the twins and ''doubtfuls.'' The special difficulties will be discussed later under loss.

DOUBTFULS.

As stated elsewhere, the designation ''doubtful'' applies to all cases where individual attention is necessary in order to rear the lamb. Aside from the ewes with twin lambs, the doubtful cases amounted to approximately 4.5 per cent of the total ewes that dropped lambs. For the most part this number was made up of young ewes that would not own their lambs and of ewes with substitute lambs. There were, however, a number of ''water-bellied'' lambs, premature lambs, deformed lambs, and a few ewes so poor and weak that special care was neesssary. All of these cases, with the twins, were placed in the two 5-acre inclosures near camp where they could be given individual attention. The twins were left unmolested until the close of the lambing period, as were most of the other ''doubtfuls.'' When, however, a single lamb was thriving well and able to shift for himself, the mother and lamb were put with the lamb band in order to give those behind a better chance.

LAMBS NOT OWNED BY MOTHER EWES.

Lambs not owned by mother ewes are very often more difficult to rear than substitute lambs. A few shepherds have expressed a belief that in certain years the failure of ewes to own their lambs pervades a flock just as a disease would. From the writer's observations, however, it would seem that the lack of affection of the ewe for her lamb can be traced to one of many causes. With young ewes, in their first lambing, the labor often results in sheer exhaustion, and the young mother totters away as if delirious. Presently the lamb gets to its feet and wanders aimlessly about the corral or field. In some cases the young ewe never comes back to look for it; and if she does, it is gone. Then both the ewe and the lamb must be caught. The excitement increases the ewe's fright and the stupidity of her actions until it is difficult to persuade her to own the lamb. Oftentimes, too, when the young ewe is weak from her labor, an unlambed "granny" ewe, or at times a yearling ewe, and occasionally a wether, will lay claim to the lamb, driving the mother away until she is discouraged. In other cases a young ewe may drop the lamb in good condition, but have no milk. It is often difficult to persuade a ewe with no milk to own her lamb. If she will do so and the lamb can be reared for a few days, the ewe's milk ordinarily will come, provided there is sufficient tender grass for forage. In still other instances the young ewe may be aided by the shepherd too early in her labor, becoming frightened and running away from her lamb while she has still much energy. If she is left until almost exhausted before aid is administered, there will be much less difficulty.

With older ewes somewhat the same causes operate—very severe pains in labor, interference of "granny" ewes, no milk, fright, and excitement, or lack of proper nourishment. With the older ewes these cases are more rare than with ewes in their first lambing. There is, however, one cause of confusion which operates more frequently with the old ewes than with the young ones. Not infrequently an old ewe will act as "granny" to a newly dropped lamb just prior to the birth of her own lamb. The writer has observed cases where the fussing over a strange lamb was begun three hours before a ewe dropped her lamb. The infatuation for the stranger too often becomes so strong that the ewe insists on claiming it and neglects her own lamb after it is born. Then the shepherd has a case of one "orphan" lamb and one lamb with two mothers.

Ewes yeaning twin lambs, if left to themselves, frequently neglect one lamb or allow a "granny" to take charge of it.

Just a little attention at the proper moment will in most cases eliminate these difficulties. If the ewe in labor can be placed in quietness by herself, there will seldom be difficulty. At the pastures the ewes were bunched closely in a corral at night, with no attention. On the range the shepherds were not expert and not too careful. The entire camp was without a sheephook, and when it was necessary to catch a ewe she was run down or lassoed—a performance somewhat pathetic to one accustomed to the stealth of a long-handled hook. As a result, there were a number of ewes not owning their lambs, and they had to be cared for.

In all cases it was found best to place the ewe and lamb in a small pen; suckle the lamb, if possible, with the ewe standing; then leave them alone until it was necessary for the ewe to have feed and water. She was then either picketed by the front foot in one of the small pastures or close-hobbled and turned loose in the pasture, where she could be watched and the lamb suckled if necessary. One of the small inclosures was kept almost exclusively for "doubtfuls" needing this treatment. If there were few other ewes to interfere, the outlaw owned the lamb with less reluctance. Care and patience in the beginning will be found most conducive to good results.

SUBSTITUTE LAMBS.

It should be the aim of every careful shepherd not to turn a good ewe out without a lamb. In the course of the lambing period a number of good ewes will yean dead, premature, "water-bellied," or deformed lambs; or a good lamb may die. In nearly every case of this nature, if the ewe has a good flow of healthful milk she can with care and patience be made to adopt a substitute lamb. The cases of failure were those in which the ewes had little milk, or had lost lambs several days old.

When a ewe yeaned a dead lamb, it was occasionally possible and convenient to exchange at once a young substitute lamb for the dead one, after first smearing the stranger well, especially on head, belly, and hind parts, with the liquids expelled along with the dead lamb by the ewe in question. The ewe would show considerable doubt at times, especially if the lamb moved too sprightly; but if the dead lamb was removed from sight and the ewe was placed in a close pen with the substitute, the adoption not infrequently was final and affectionate.

In most cases it was necessary to resort to the time-worn device of removing the dead lamb's pelt and fitting it onto the substitute. This, accompanied by a smearing of the uncovered parts with the blood of the dead lamb, best done by taking out the liver and smearing with it, usually resulted in adoption, if the ewe was kept for a short time in a pen with the substitute.

It was found occasionally that lambs a few days old when placed on a fresh ewe did not do well; nor did newly born lambs always prosper when placed on a ewe whose milk had been drawn for several days. There apparently is considerable change in the ewe's milk during this period, and care should be used to choose, where possible, a substitute lamb near the age of the original. The lamb's stomach is delicate, and a change in milk may upset it and prove fatal.

TWIN LAMBS.

Except for a few which were used as substitutes, the twin lambs were placed with the mothers in the small inclosure kept for that purpose. They remained there during the entire lambing period. There was little trouble in rearing them, and by July 1 they were, without exception, good lambs.

MANAGEMENT OF EWES DURING LAMBING—OUTSIDE BANDS.

A few words are needed concerning the management of the outside bands used for comparison. In most of these bands the yearlings were separated from the lambing ewes before the lambs began to come. A central camp was then established and in most cases a corral was provided, although in at least one the ewes were not corraled at night. The crew for a band numbered from 5 to 7, usually 3 or 4 men and several boys.

No attention was given the ewes during the night except in very late evening and very early morning. The men worked long hours and diligently. In the main the plan was to put the drop of each day in a bunch by themselves and keep them thus as long as possible. One could find bunches, varying in number from a few to 50 ewes, scattered about the lambing allotment anywhere within a radius of a mile from the main camp. Where aspen pole timber was handy small, crude corrals were constructed as a protection for each small band at night. Very frequently, however, they were left unprotected where they had been during the day. Aside from the small bunches thus scattered, single ewes—"doubtfuls"—could be found in pens, picketed, or hobbled about the range.

It is evident that unmolested quiet for the ewes with lambs was the aim of the shepherd under this system, as it was in the pastures. Where coyotes and cats are few in number and the weather favorable it works well. Where it does work well, the advantages of the pasture are less pronounced, but there is always the advantage of possible individual attention to the twins and "doubtfuls." During the lambing season in question the ewes, with few exceptions, were in good condition; the range was at its best; the weather was the most favorable for years, and predatory animals gave but little trouble. It is, therefore, interesting to compare the results secured at the pasture with those secured by owners of outside bands.

RESULTS.

The actual results at the pasture and those secured by 8 sheep men within a radius of 10 miles from it are presented in Table 3. It was not possible to get accurate data from all the bands listed. Shepherds, or sheep owners themselves, rarely keep such records, and the Forest Service could have secured them only by having a man permanently at each camp. The total number of ewes, however, and the total number of lambs marked were taken from counts made jointly by the sheep men and representatives of the Forest Service. They are the most important items for comparison and the figures can be relied upon. The number of dry ewes and the number of ewes that yeaned twins were based upon statements of the men in charge of each band. The remaining columns were computed.

TABLE 3.—*Comparative data on lamb crop.*

Year.	Approximate date of lambing.	Owner.	Total ewes.	Ewes lambed.	Ewes yet to drop lambs.	Dry ewes.	Single lambs.	Ewes yeaning twin lambs.	Total lambs yeaned.	Total lambs marked.	Total lambs lost.	Per cent of lambs marked.[1]	Per cent of lambs lost.
1910	May 20 to July 5.	Experimental band.	1,006	900	9	97	878	22	922	853	69	84.8	7.4
1910	May 10 to July 20.	T. M. Alexander..	869	476	.....	393	466	10	486	375	111	43.2	22.8
1910	May 20 to July 5.	J. N. Espinosa....	1,044	930	39	75	915	15	945	809	136	77.5	14.4
1910	...Do......	J. D. Espinosa....	1,100	990	40	70	945	45	1,035	903	132	82.1	12.8
1910	May and June.	Susano Truzillo ..	728	618	.....	110	616	2	620	562	58	77.2	9.4
1910	May 15 to June 20.	J. E. Torres......	735	(2)	.....	.....	.....	.....	.....	619	.....	84.2	.....
1910	June 1 to July 5.	Humphrey Fullerton.	950	900	.....	50	894	6	906	850	56	89.4	6.2
1910	May and June.	C. J. Torres.......	1,625	1,150	.....	475	1,134	16	1,166	987	179	60.7	15.4
1910	May 20 to July 5.	J. A. Kelley......	1,534	1,110	240	184	1,096	14	1,124	1,069	55	69.7	4.9

[1] These percentages refer to the number of lambs marked as compared with the total of breeding ewes in the band.

[2] No reliable figures.

DISCUSSION OF RESULTS.

For all the camps trouble from predatory animals was very slight, and the direct loss from this source was almost negligible.

It will be noted that the final marking at the pasture was exceeded only by one band—that of Mr. Humphrey Fullerton. Without having personally studied Mr. Fullerton's methods, losses, and results in detail on the ground, the writer is not justified in commenting further than to say that the Fullerton ewes were lambed on range lower in altitude and somewhat warmer and drier than the experimental allotment.

The bands which will admit of comparison and discussion are those of J. N. Espinosa and J. D. Espinosa. These two bands were lambed during the same time as the experimental band, and on adjoining range. The Espinosa Brothers have been successful sheep men for years, and for years each has personally superintended the lambing of his ewes on the range used in 1910. Consequently they were thoroughly familiar with their allotments and all the difficulties to be expected. In 1910, as in other seasons, they remained constantly on the ground, and worked incessantly, and the results obtained in 1910 as well as in other years were conceded to be about as good as could be secured under the conditions. Their average number of lambs saved has for years been between 75 and 85 per cent of the total number of ewes.

J. N. Espinosa separated the yearlings from the ewes before lambing began; his lambing ewes were similar in age and breeding to the experimental band; his range was similar to the experimental allotment; and the lambing crew consisted of 3 men and 4 boys. The experimental band were lambed, without separating the yearlings, by a crew of 3 men besides the cook. Four men should be actually working with the sheep. It will be noted that under these conditions the number of lambs marked from the experimental band exceeded the number from the J. N. Espinosa band by 7.3 per cent.

The band belonging to J. D. Espinosa contained no 2-year-old ewes; as shown by Table 3, more twin lambs were dropped than in the other bands; they were lambed by a crew of 4 men and 1 boy. The total number of lambs marked was only six-tenths of 1 per cent less than the number marked from the experimental band.

The band belonging to J. A. Kelley were pure-bred ewes—Rambouillet and Hampshire. They were given excellent care, but the figures were obtained when the lambing was not advanced far enough for conclusions. At best, this case would hardly be comparable to the pasture lambing. The results from other bands listed will serve merely to give a proper idea of the results obtained generally in that locality.

INCREASE IN LAMBS SAVED DUE TO PASTURES.

It is difficult to draw conclusions as to the number of lambs actually saved by the pastures method. Where a large number of twin lambs are dropped, they can be saved and developed into good lambs in pasture with but slight loss. Where few twins are dropped, this advantage does not exist. Careful consideration of the conditions met with in connection with lambing ewes on the range, in pastures, and in sheds, has convinced the writer that the average saving which can be made in the number of lambs, by the use of such a system of pastures in connection with range lambing, will approximate 5 per cent. When the range and weather conditions are favorable and predatory animals do not give trouble, the saving may be as low as 2 per cent. On the other hand, when range is poor in quality and in adaptability to the needs of lambing, and coyotes are troublesome. the saving by that method may exceed 5 per cent.

CAUSES OF LOSS FROM EXPERIMENTAL BAND.

As a matter of interest, and in order that undue loss may not be charged to the handling in pastures, the total number of lambs yeaned by the experimental band are accounted for in Table 4 and the discussion following.

TABLE 4.—*Loss of lambs from experimental band.*

Total lambs yeaned.	Lambs yeaned dead or premature.	Single lambs lost in pastures.	Twin lambs lost in pastures.	Single lambs over 5 days old lost on range before marking.	Total lambs lost.	Total lambs marked.	Per cent of lambs lost.
922	17 (1.8 p. c.)[1]	25 (2.7 p. c.)	2	25 (2.7 p. c.)	69	853	7.5

---

[1] It is interesting to note in this connection that the accurate record for a full band lambed under the corral system in northeastern Oregon, 1909, gave the lambs yeaned dead or premature as 1.7 per cent. See Forest Service Circular 178, p. 37.

LAMBS YEANED DEAD OR PREMATURE.

Of the 17 lambs yeaned dead or so premature that they soon died, 9 were mature but dead when yeaned and 8 were premature. Of the 9 mature lambs 7 were yeaned in the corral during the night or in early morning with aid from the shepherd. The other 2 came dead on the range. The majority of these cases were such that a little aid from the shepherd at the right time would have saved them. Most of the premature lambs were alive when yeaned, but were only about one-half normal size, and the bones were somewhat soft. In spite of an effort to save them they died within a few hours or at most a few days. Most of these cases, also, occurred in the corral during the night. The corral was open at one end and was guarded by the sheep dog. A strange dog troubled the sheep a few times at night. It is possible that a few cases of the premature labor were attributable to severe excitement and jamming as a result of such disturbance. At least, care should be exercised to keep the ewes free from disturbance.

SINGLE LAMBS LOST IN PASTURES.

Of the 25 single lambs lost in the pastures 6 were "doubtfuls" that died from starvation. The mothers had very little milk in the beginning and failed to own the lambs. After they were made to take the lambs, the milk flow gradually dried up instead of increasing as it should do. Of the remaining 19, 3 fell into prairie-dog holes and died before found by the shepherd, and the other 16 were choice lambs which died of a disease termed by the shepherd "milksickness."

This last cause of loss was most alarming, for the reason that as many as 4 died in one day and, further, because it always attacked the most thrifty lambs, usually at the age of 3, 4, or 5 days, just when they appeared to be thriving. Choice lambs that were playing at dusk would be found the next morning with head drooping, eyes dull, abdomen swollen, heaving at the flanks until the back presented a rainbow outline, and moving only when forced to. Nearly always a lamb showing such symptoms would die inside of five hours. At first the ailment was attributed to lying on damp, cold ground at night. As the loss continued, however, it was noticed that only lambs belonging to excellent ewes with abundance of milk were attacked—nearly always Shropshire ewes. Post-mortem examinations were made. The true stomach of the first lamb examined contained what was estimated as 1 pound of hardened curd, in lumps varying from the size of a hen's egg to mere pellets. Aside from this, the stomach contained about a pint of wheylike but rather slimy liquid. A number of other lambs examined showed the same conditions. In one the stomach was almost filled with the hard curd. During the period of illness the discharge was limited to mere drops of pale greenish, wheylike fæces.

The fact that only the most thrifty lambs were attacked; that in nearly every case the afflicted lamb was mothered by a Shropshire or Lincoln ewe with abundance of milk; and that withered, half-starved lambs were not attacked, is rather conclusive evidence that the disease was not due, at least entirely, to lack of protection from the cold ground and the weather. It was perhaps aided by the cold retarding somewhat the activity of the stomach, but in the main the writer attributed the attacks to hardness in the milk and an excess of milk. At any rate this loss of nearly 2 per cent of the best lambs can not be attributed to the method of handling after the lambs were yeaned.

Inquiries made of shepherds and sheep men who have worked for years in this vicinity during the lambing period revealed the fact that usually there is a loss from this source. Notwithstanding the fact that it may reach 2 per cent of the best lambs, as in the case of the experimental band, no effort has been made in that locality to ascertain definitely the cause or to save the lambs. The cause of the disease rests with one or both of two conditions—excessive hardness in the milk, and diminished energy of the stomach, due perhaps to lying on damp, cold ground. In the season of 1911 small sheds will be constructed at the pastures to protect the young lambs, and in case of a recurrence of the disease analysis will be made of the milk if possible. If the trouble lies with the milk it may be practicable to feed the necessary ingredients to the ewe along with salt.

It is evident that any treatment to be effective must in a short time dissolve the coagulation of curd. The Shepherd's Manual[1] recommends: "Carbonate of magnesia, half ounce, mixed in water, to be followed by half an ounce of epsom salts in a teacupful of water." This should be given twice and then followed by an astringent composed of prepared chalk, 1 ounce; powdered catechu, 4 drams; powdered ginger, 2 drams; powdered opium, ½ dram; and peppermint water, 1 pint. Youatt,[2] in his treatise on sheep, recommends a similar treatment.

In giving so much space to this item of loss and a recommended treatment the writer is not ignorant of the fact that to date a range shepherd in the West is not expected to carry a medicine chest. It it believed, however, that the day of extensive ownership and small increase is passing and that more attention will be paid to the saving of an extra 5 or 10 per cent of the increase. Range is in such demand that a lamb crop of only 60 or 75 per cent is not justifiable.

SINGLE LAMBS OVER 5 DAYS OLD LOST ON RANGE PRIOR TO MARKING, JULY 3.

All of the lambs put onto the range were single lambs over 5 days old and in good condition before they were removed from the pastures. Nevertheless, there was a loss of 25 lambs, 2.7 per cent of the total number yeaned, between the time they were turned out and the end of the lambing period. Until June 17, at which time the lambs in the band numbered 661, the loss had been slight. At that time they were removed to a portion of the summer range and no record was kept until the final count on July 3, which showed a shortage of 25 lambs. The writer had no jurisdiction over the sheep after they were turned out of the pastures.

---

[1] Stewart, The Shepherd's Manual, p. 246.

[2] Youatt on Sheep, pp. 132 et seq.

This loss was larger than it should have been, and it emphasizes the necessity of placing the most painstaking shepherd available with the flock during this period.

The young lambs lie about in the shade while the mothers drift away to feed. The only safe way to get them with the ewes again is to graze the ewe band back over the ground. If a shepherd attempts to drive the lambs they run in every direction, and it is a stroke of good fortune if, in the course of two weeks, some of them are not fatally injured, fatally overheated, or lost. On the other hand, a shepherd who works the ewe band back over the range frequently, to pick up the lambs, and is careful to avoid excitement or jamming, should come to the final count at the close of lambing with no greater loss than that due to an occasional diseased lamb or to an occasional injury inflicted during their natural play. This loss will, at best, approach 1 per cent, but only in rare cases should it exceed 1 per cent.

ADVANTAGES OF SUCH A SYSTEM OF PASTURES.

It would be unwise on the strength of data derived from only one year's test to attempt any conclusive statements as to whether the pasture system should or should not be adopted generally. Inquiries have been made of the Forest Service, however, as to the advantages to be gained over the open range handling, and a number of sheep men have expressed an intention to construct pastures similar to the Cochetopa system. This being the case, it seems advisable, at least, to point out more distinctly than has been done the advantages, and to give some idea as to whether these advantages are likely to justify the cost of construction. Under advantages may be considered:

1. Increase in the percentage of lambs saved.
2. Decrease in the amount of labor necessary.
3. Both ewes and lambs in better condition at the close of the lambing period.
4. Greater degree of certainty as to what percentage of the lambs yeaned can be saved.
5. Elimination, to some extent, of the worry attached to the task of securing sufficient reliable labor to care for the ewes during the lambing period.
6. Decrease in acreage of range necessary.

INCREASE IN THE PERCENTAGE OF LAMBS SAVED.

It has already been pointed out that the increase in the number of lambs saved will depend upon several conditions. If the range is of good quality, large enough to afford plenty of room to broadcast the small bunches, well sheltered by clusters of timber, and untroubled by animals which prey upon the unprotected lambs, and if these conditions are strengthened by efficient labor, the pastures would add but little to the lamb crop. At best, however, even where the ewes yeaning twin lambs are few in number, approximately 5 per cent of the total of lambs yeaned will be twins and "doubtfuls," needing special care. Of this 5 per cent, approximately 2 per cent will be cases calling for individual attention of such nature that some provision for handling will be necessary. Under the present range conditions the ideal lambing ground, as outlined above, is at a premium. More frequently the allotment is small, feed poor, shelter lacking or insufficient, and labor not the best. The writer does not hesitate to say that in such cases inclosures to keep the young lambs in small bunches, free from confusion and "mixing" until they are 5 days old, a few inexpensive sheds providing shelter in case of storm, and compartments to facilitate the handling of doubtful cases will easily result in a saving of an additional 5 per cent of the lambs yeaned.

DECREASE IN AMOUNT OF LABOR NECESSARY.

The decrease in labor necessary will depend upon the locality. With this system of inclosures to facilitate handling the "doubtfuls" throughout the lambing period, and all the lambs until 5 days old, the writer with the aid of 2 good men would not hesitate to undertake the lambing of 1,000 ewes. One man would have constant charge of the lambing ewes; a second man would care for the lambs dropped on the range and, when necessary, would aid at the pastures until the first 500 lambs had been yeaned. He would then take charge of the lamb band. The third man would look to the corral and pastures. After 500 ewes had yeaned, 2 men could care for the unlambed ewes and the pastures. It would be much better, however, to have a night shed[1] and a fourth man to attend the ewes at night. This arrangement would avoid much confusion, much labor resulting from a lack of such attention, and a loss of at least 1 per cent. On the Cochetopa Forest, where the crew on open range is from 5 to 7 men and boys for each band, the pasture crew of 3 men would mean a saving in labor, on the average, of 2 men and a boy. At the wage paid—$30 and board per month for the men and perhaps $20 and board for the boy—the cash outlay saved for a lambing period of one month would be, for labor $80, and for board approximately $35, a total of $115 for one season. In northeastern Oregon, where 7 or 8 men are employed for each 1,000 ewes and an average wage of $45 and board per month is paid, the pasture crew would mean a saving of approximately $150.[1] In other localities of the West the saving would be between these two.

---

[1] For description of such a shed and duties of night attendant, see Forest Service Circular 178, pp. 34 and 35.

EWES AND LAMBS IN BETTER CONDITION AT THE END OF THE LAMBING PERIOD.

The money value accruing from having both ewes and lambs in better condition at the close of the lambing period is hard to estimate. The extent of advantage of the pastures in this respect will again depend to a considerable degree upon the character of the range. If a band has abundance of room, good forage, shelter, and few or no predatory animals to cause disturbance, the quiet freedom essential to rapid progress in growth and condition of both ewes and lambs can be secured without pastures. Again, it may be said that a lambing ground with such characteristics is the exception rather than the rule. More frequently the ewes must work incessantly during the day for sustenance, and then be jammed into a corral at night for protection against coyotes. It is almost impossible to drive a bunch of ewes with lambs a few days old without more or less confusion. In keeping track of her lamb and attempting to coax it to follow, a ewe will frequently run about much more than is necessary, especially if the shepherd attempts to urge the lamb along with any speed. This worry and action consumes energy, and consequently nourishment, which should go to the production of milk and flesh in the mother and growth in the lamb. Rapid progress in the growth of the lamb from the first day on can hardly be overestimated, especially where the lambing season is late May and June. In four or five months a carcass and flesh weighing 60 pounds or more must be developed if the production of lambs for fall market is profitable. On our western ranges the growth must be produced by milk and range forage alone, and every advantage possible of quiet and freedom should be given. The freedom and protection of the pasture, even for the first five to seven days, is an advantage difficult to estimate in cash value, but one which will be understood and appreciated by men accustomed to handling ewes and lambs under range conditions.

GREATER DEGREE OF CERTAINTY IN THE LAMB CROP.

Without doubt such a system of pastures in connection with a lambing allotment makes more certain the percentage of the lambs yeaned that can be saved. Unless good feed, quiet, and some attention can be given to ewes yeaning twin lambs, the twins are a nuisance and one might best be killed. When they can be kept in an inclosure unmolested on the best feed the allotment affords, by the close of the lambing season they will be good, thrifty lambs. Also, by the aid of a small inclosure it is possible to find a lamb for nearly every ewe turned out. Without some such facility for individual attention this can not be successfully done, as it is not practicable to properly care for a large number of such ewes when they are hobbled about the range. In addition to these two features, the pastures afford additional assurance against loss by coyotes.

---

[1] For cost of lambing in northeastern Oregon, see Forest Service Circular 178, pp. 34–37.

DIFFICULTY AND WORRY OF SECURING LABOR PARTLY ELIMINATED.

There is also the advantage of protection against difficulties arising from insufficient or uncertain labor. Even if the foreman were left alone with the ewes in the middle of the lambing season, he could put them all into the pastures and care for them with little loss for a few days until additional help could be secured. In many sections of the West the sheep owners are subjected to no little worry and loss of time personally in securing proper help for the lambing season. This difficulty is to some extent decreased by the pastures, which make it possible for three or four men to care properly for a band of 1,000 or 1,200 ewes, and by the additional assurance, already mentioned, that in case of exigency one man can care for the whole band for a short time.

DECREASE IN THE ACREAGE OF RANGE USED.

The decrease in the acreage of range used due to the system of small pastures will not be large except in cases of very careless handling under the open-range system. Ordinarily it will be limited to the saving accruing from the quiet handling of the small bunches, which in all cases is essential until the lambs are 5 or more days old. The main advantage of the smaller acreage necessary is the possibility of keeping the small bunches from mixing on allotments where sufficient room is lacking to broadcast them properly.

MONEY RETURNS FROM INCLOSURES.

From the nature of the advantages pointed out in favor of such a system of pastures—advantages which, it is believed, sheepmen will recognize—the difficulty of deducing figures to show the proper relation of these advantages to the cost of construction will readily be seen. However, disregarding all factors except the cash saving for labor and the increased lamb crop, the following estimate will give an idea of the possible economic return.

The cash outlay for the construction of a suitable system of inclosures by a sheep owner would approximate $1,000. The average cash saving on labor and supplies for each lambing season would approximate $140. Placing the increase in the number of lambs saved at 4 per cent on a band of 1,000 ewes and valuing the lambs at $2.50, the gain from this source would amount to $100 each season. This would give a total yearly return on the investment, exclusive of upkeep, of $240, or 24 per cent. With a fence properly constructed the yearly cost of maintenance would be most negligible for the first five years. Thereafter it would be necessary in places to put on new ground wire and, at odd times, to replace posts. If interest is reckoned at 8 per cent, by the close of the sixth year the fence would, with cost and returns as given above, entirely pay for itself and in addition leave a clear profit of $173.74.

While it is recognized that the figures given will probably not apply accurately to any one locality for any one year, it is believed that the estimate is conservative and that in five or six years the advantages will outweigh the expenditures. It will be remembered that Mr. Taylor's statement of his personal venture with a pasture for the entire band gave three years as the period in which the fence would pay for itself. Where cash value is attached to all the factors discussed, the experimental results from this system of small inclosures, as well as from the fencing of an entire lambing ground, tend to substantiate Mr. Taylor's statement. It will be noted, however, that the estimate here given is based merely on the tangible saving. The sheep owner himself is best prepared, for the present, to set the cash valuation upon the other factors. An effort has been made to put the experimental data in a form suitable to serve as a guide to him in deciding whether or not such an investment would be profitable under the conditions with which he is confronted.

O